Title page

Title: Launching and evaluating a mobile phone app to provide contemporary, evidence-based advice about self-treatable conditions

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Keywords: evaluation evidence-based medicine, healthcare, medical education, patient-centred care, progress

Number of words: 2918 (including title page)

Short summary

Rationale, aims and objectives: As government-funded healthcare provisions are stretched to their limits, it is important that healthcare professionals provide evidence-based advice about minor ailments to facilitate people to self-treat these effectively and appropriately. Unfortunately, despite the expanding over-the-counter (OTC) medicines market, there have been doubts cast about advice given by UK community pharmacists. Indeed, research conducted with pharmacists revealed that evidence of effectiveness was a secondary consideration when making decisions about OTC recommendations. We aimed to address these concerns and support decision-making by providing high quality, evidence-based, information about self-treatable conditions and over-the-counter consultations through a mobile phone app.

Method: There were four main stages, namely: app development (content and design); piloting (use-testing); publication on Apple and Android stores and marketing of the app, and finally an evaluation (using analytical data obtained through the app content management system, feedback obtained via email, the star-rating and reviews posted on Google Play and Apple stores, and comments obtained at events. Additionally, following ethical approval and piloting, we invited one hundred people representing different groups within the pharmacy profession in Northern Ireland to complete an evaluation questionnaire).

Results: Since launching in February 2017, there have been over 2726 downloads, 34491 sessions of use, and it has received a 5-star rating on both Apple and Google Play stores. Positive feedback has centred on the material being relevant and up-to-date, that it facilitates quick access to information in the workplace and is easy to navigate, and is a good training tool. Future suggestions for improvement include expanding the number of conditions and providing self-assessment questions to help students prepare for professional examinations.

Conclusions: The app appears to have had a positive impact on OTC consultations but it is still evolving to ensure its usefulness in practice is maximised.

Introduction

In 2014, there were 3.7 million visits to Accident and Emergency (A&E) hospital departments for self-treatable conditions, at a cost of £290 million to the National Health Service (NHS) [(1)]. Furthermore, around 57 million general practitioner (GP) appointments per annum are for self-treatable conditions, costing the NHS £2 billion [(1)]. As NHS resources are stretched to their limits, it is important that healthcare professionals provide evidence-based advice about minor ailments to facilitate people to self-treat these effectively and appropriately. Many over-the counter (OTC) medicines to treat such ailments are available in community pharmacies across the United Kingdom (UK); this market continues to expand with three further prescription-only deregulations in July 2017 [(2)]. Indeed, in the UK in November 2017, sildenafil (Viagra Connect®) was deregulated from prescription-only status for men aged 18 years and over for erectile dysfunction [(3)]; the UK is the first country in the world to approve this deregulation [(3)].

Unfortunately, there have been doubts cast about advice given by UK community pharmacists and research conducted with pharmacists revealed that evidence of effectiveness was a secondary consideration when making decisions about OTC recommendations [(4-9)]. We sought to address these concerns and support decision-making by providing high quality information through a mobile phone app. Many medical apps make mobile devices valuable tools within healthcare education to aid clinical decision-making and knowledge-base at the point of care, and have been shown to have positive effects on patient outcomes including reducing adverse events and length of stay in hospital [(10,11)].

It was anticipated that our app could enable the public to receive best practice management strategies for self-treatable conditions, leading to increased satisfaction and positive healthcare outcomes (whilst reducing the amount of time and money wasted on inappropriate options). It also had the potential to improve standardisation of care. It is relevant to any healthcare professional who provides advice to patients about self-treatable conditions. To the best of the authors' knowledge, there are no similar apps available that directly relate to OTC consultations [12,13]. While information is published by providers such as the National Institute for Health and Care Excellence (NICE) and in textbooks, it is either not specifically tailored for pharmacy use, for example, it doesn't take into account marketing authorisations of over-the-counter medicines, or quickly goes out of date.

The aim was to publish an app in the Apple and Google Play stores that provides evidence-based clinical information on OTC medicines and self-treatable conditions.

The objectives were to:

1. Search and critically evaluate the literature for information pertaining to the OTC treatment of self-treatable conditions;
2. Produce summaries for conditions with management strategies encompassing pharmacological and non-pharmacological advice;
3. Design an attractive app interface that allows rapid navigation to the information (and functionality that enables amendments and updates to reach the downloaded app)

Methods and materials

A Gantt chart was prepared for the bursary application; work on the app started in June 2016 with a proposed publication deadline of the end of January 2017. Six months following publication, an evaluation was conducted.

Development of content involved a literature search and critical analysis of material in terms of its relevance to OTC consultations. Key therapeutic areas investigated were: children's health; eye and ear; gastrointestinal conditions; musculoskeletal conditions; nervous system; respiratory conditions; skin conditions; skin infections; travel health and women's and men's health. These ten areas were then further sub-divided to encompass minor ailments/conditions within each (for example, within the therapeutic area 'respiratory conditions' are: acute sinusitis, allergic rhinitis, sore throat, cough, common cold and influenza). The main headings for each condition were: clinical features, referral criteria, time frame to resolution, and a management strategy (non-pharmacological and pharmacological advice). Resources used to populate the app content included Cochrane Systematic Reviews, relevant Medicine and Healthcare products Regulatory Agency (MHRA) medicine safety announcements, the Electronic Medicines Compendium (i.e. the Summary of Product Characteristics and Patient Information Leaflets relating to specific OTC products), the National Institute for Health and Care Excellence (NICE) pathways and NICE Clinical Knowledge Summaries (CKS), the Faculty of Sexual and Reproductive Healthcare (FSRH), and other reputable organisations such as Travel Health Pro.

In terms of app creation, the bursary obtained was used to pay Bluemonkee™ Digital to support us to publish the app. The experienced developer prepared one condition and provided training on the content management system (CMS) to enable the authors to design the remainder (over seventy individual conditions). This required the authors to independently gain expertise in graphic design and to become familiar with HyperText Markup Language (HTML) and produce the app name.

The content was peer reviewed by colleagues who had expertise in the area of OTC medicines. The pilot (use testing) involved registered pharmacists and postgraduate pharmacist PhD students with Apple and Android devices. Feedback centred on including some photographs to aid with diagnosis of certain conditions, therefore stock images were purchased and a photo gallery created. More information on recently deregulated prescription-only medicines was wanted, so a separate section relating to these medicines was prepared. Some pilot participants desired health promotion advice, so we added the UK vaccination schedule, UK adult screening programmes and information about staying off nursery and school in relation to various infectious conditions. The original name was changed to enable the app to be found more easily in the App stores.

Once it was published on Google Play and Apple stores in February 2017 (free of charge to download), we marketed it by approaching popular UK pharmacy publications, had Facebook coverage, attended a digital literacies conference, and exhibited the app at a healthcare 'Inspiring Change' event. Currently is has been shortlisted for an 'E-Health and Innovation Award' (winners will be announced on 27th January 2018 at a prestigious event) which has resulted in indirect publicity since the awards event being hosted by a UK television celebrity.

Six months after publication, a multi-faceted evaluation of the app was conducted. Quantitative data was obtained through the CMS. Feedback was also obtained via email, the star-rating and reviews posted on Google Play and Apple stores, and comments at the conference and event. [The push notification function failed as a method of communication due to an unresolved technical issue]. Additionally, following ethical approval (reference number: 017PMY2017), we invited one hundred people representing different groups within the pharmacy profession in Northern Ireland (pharmacy undergraduate students, pharmacy graduates who were

undertaking their compulsory placement year prior to registration/licensing, and community pharmacists) by email or letter to complete an evaluation questionnaire. The authors had access to students' and graduates' university email addresses, so a random sample of these cohorts was emailed (20 final year undergraduate pharmacy students who were currently learning about over-the-counter consultations and 30 graduates undertaking their compulsory placement year in community pharmacy practice). To access the pharmacists, 50 addresses from the list of registered NI community pharmacies[10] were randomly selected and invitations and questionnaires posted to them (addressed to 'The Pharmacist', with a pre-paid return envelope included). The short evaluation questionnaire had four questions with several parts to each (largely closed-type) and is available on request from the corresponding author. It largely focussed on what they liked and did not like about the app including rating its usefulness in practice. Respondents who had never used the app before were asked to explain why this was the case and also asked to download the app so that they could provide feedback about it. To enhance the response rate [(14)], a reminder email was sent to all undergraduate and graduate students (and a reminder letter with pre-paid envelope was sent to the same random selection of pharmacies) with a statement to ignore the invitation if they had already participated. The responses from the completed questionnaires were coded and entered into a customized database developed on IBM SPSS v22 (SPSS Inc., Chicago, IL) for statistical analysis. Data analysis largely took the form of descriptive statistics and key themes were derived from the qualitative free-response comments (thematic analysis) [(15)].

Results

Since launch of the app in February 2017, the analytics from the CMS are:

- Downloads: 2011 (Apple); 715 (Android)
- Sessions: 25213 (Apple); 9278 (Android)

- Average session length: 2.5 minutes (Apple); 2.4 minutes (Android)
- Top 10 user locations (by session numbers): UK, Ireland, US, Egypt, Saudi Arabia, Hong Kong, Malaysia, Australia, Iran and Netherlands.

It has a 5-star rating on Google Play and Apple stores; examples of user reviews (posted on Google Play and Apple stores) are:

"A really useful app…easy to navigate and it's great that it's so up to date. Have already used it with our technicians in a training session..."

"…a super app which is very focussed on supporting pharmacists and the pharmacy team to provide evidence-based and complete patient care."

"…a great help."

Questionnaire: a 27% response rate was obtained. Mean score for 'usefulness in practice' (1 'not useful' to 5 'very useful') = 4.1. Only one respondent stated that he/she could not download the app or provide feedback on it as he/she did not have an android or apple device.

Overall summary of positive and negative aspects (from the evaluation questionnaire free-response questions and other qualitative feedback):

Positive aspects: quirky design (particularly avatars); easy to navigate; facilitates quick access to information; information is evidence-based, up-to-date, and relevant; good staff training tool (particularly the photo gallery).

Negative aspects: requires internet access, limited search capabilities; would like more conditions and medicines to be covered and a section relating to self-assessment.

Discussion

The app appears to have had a positive impact on OTC consultations. Despite a steep learning curve and time-intensive process, developing it was rewarding and the authors look forward to enhancing it in the future. The authors hope that this paper encourages others to consider undertaking a similar project. The key findings are similar to those reported elsewhere in relation to usefulness as an educational tool at undergraduate level for medical and pharmacy students [16-18] and to support clinical decision-making in practice [19-23].

It must be noted that the response rate to the evaluation questionnaire was low, risking non-response bias. However, this was only one aspect of the overall app evaluation. Moreover, some data (such as locations) are only gathered in the CMS if users have enabled particular settings on their phones. While the overall project aim was met (to publish an app in the Apple and Google Play stores that provides evidence-based clinical information on OTC medicines and self-treatable conditions), we do not know whether patient outcomes have improved.

Future improvements to the app will include expanding the number of conditions, providing some pertinent information on complementary and alternative medicines (such as the evidence-base for common therapies, including effectiveness and safety data), and self-assessment questions to help students prepare for professional examinations. We are investigating ways that allow the data to be stored locally, and strive for better push notification and search functionality. However, storing the data locally means that users would not obtain any changes automatically as is currently the case (i.e. the onus would be on the user to ensure they had done the required app updates). Engagement and functionality could be enhanced by including relevant stakeholders in discussions about future developments.

Conclusion

Following the launch in February 2017, this mobile phone app has been well received as a valuable tool to support and enhance patient care with regard to self-treatable conditions. The app has relevance to any healthcare professional who provides advice to patients about such conditions and the work should be of value to those interested in developing educational mobile phone applications. Marketing of the app has been successful to some degree as determined by the number of downloads, but more could be done to publicise the app within and beyond the pharmacy profession. In addition to use-testing prior to the launch onto Apple and Google stores, conducting a post-launch evaluation was a worthwhile exercise. The evaluation data revealed that the app has many positive features with the collation of contemporary information from numerous evidence-based resources facilitating decision-making at the point of care. However, several ways that the app could be adapted to maximise its usefulness have also been exposed. The time commitment for this work should not be underestimated, both in the development stage prior to launch and thereafter. Due to the dynamic nature of the clinical subject material, a strategy about maintaining and enhancing the content is required, coupled with an ongoing commitment to make *ad hoc* changes as necessary to mirror changes in practice and meet the needs of relevant stakeholders.

Acknowledgements

We acknowledge the CW Young Bursary (http://forum.psni.org.uk/awards-and-bursaries/cw-young-bursary/) which provided financial support enabling us to undertake this work.

Declarations of interest The authors report no declarations of interest.

References

1. Proprietary Association of Great Britain. 2017. Report: self care nation: self care attitudes and behaviours in the UK. https://www.pagb.co.uk/latest-news/report-self-care-nation-self-care-attitudes-behaviours-uk/ Accessed December 2, 2017.
2. GOV.UK. 2017. Reclassification of Otrivine Extra Dual Relief, Nasonex Allergy Control and Maloff Protect. https://www.gov.uk/search?q=reclassification Accessed December 2, 2017.
3. Medicines and Healthcare products Regulatory Agency (MHRA). 2017. MHRA reclassifies Viagra Connect tablets to a Pharmacy medicine. https://www.gov.uk/government/news/mhra-reclassifies-viagra-connect-tablets-to-a-pharmacy-medicine Accessed December 8, 2017.
4. Hanna LA, Hughes CM. 'First, do no harm': factors that influence pharmacists making decisions about over-the-counter medication: a qualitative study in Northern Ireland. Drug Saf. 2010;33(3):245-55. doi: 10.2165/11319050-000000000-00000.
5. Hanna LA, Hughes CM. Pharmacists' attitudes towards an evidence-based approach for over-the-counter medication. Int J Clin Pharm. 2012;34(1):63-71. doi: 10.1007/s11096-011-9586-y.
6. McKee P, Hughes CM, Hanna LA. Views of pharmacy graduates and pharmacist tutors on evidence-based practice in relation to over-the-counter consultations: a qualitative study. J Eval Clin Pract. 2015;21(6):1040-6. doi: 10.1111/jep.12295.
7. Rutter P, Wadesango E. Does evidence drive pharmacist over-the-counter product recommendations? J Eval Clin Pract. 2014;20(4):425-8. doi: 10.1111/jep.12157.
8. Watson MC, Bond CM. 2004. The evidence-based supply of non-prescription medicines: barriers and beliefs. Int J Pharm Pract. 2004;12(2):65-72. doi: 10.1211/0022357023475.

9. Which? 2013. Can you trust your local pharmacy's advice? http://www.which.co.uk/news/2013/05/can-you-trust-your-local-pharmacys-advice-319886/ Accessed December 8, 2017.
10. Divall P, Camosso-Stefinovic J, Baker R. The use of personal digital assistants in clinical decision making by health care professionals: a systematic review. Health Informatics J. 2013;19(1):16-28. doi: 10.1177/1460458212446761.
11. Mickan S, Tilson JK, Atherton H, Roberts NW, Heneghan C. Evidence of effectiveness of health care professionals using handheld computers; a scoping review of systematic reviews. J Med Internet Res. 2013;15(10):e212. doi: 10.2196/jmir.2530.
12. Mosa AS, Yoo I, Sheets L. A systematic review of health care apps for smartphones. BMC Med Inform Dec Mak. 2012;12(1):67.
13. Wiechmann W, Kwan D, Bokarius A, Toohey SL. There's an App for That? Highlighting the Difficulty in Finding Clinically Relevant Smartphone Applications. West J Emerg Med. 2016;17(2):191-194. doi: 10.5811/westjem.2015.12.28781.
14. Edwards PJ, Roberts I, Clarke MJ et al. Methods to increase response to postal and electronic questionnaires. Cochrane Database Syst Rev. 2009; 3: MR000008. DOI: 10.1002/14651858.MR000008.pub4.
15. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3(2):77-101.
16. Rodis J, Aungst TD, Brown NV, Cui Y, Tam L. Enhancing Pharmacy Student Learning and Perceptions of Medical Apps. JMIR Mhealth Uhealth. 2016;4(2):e55. doi: 10.2196/mhealth.4843.
17. Briz-Ponce L, Juanes-Méndez JA, García-Peñalvo FJ, Pereira A. Effects of Mobile Learning in Medical Education: A Counterfactual Evaluation. J Med Syst. 2016;40(6):136. doi: 10.1007/s10916-016-0487-4.

18. Zhang MW, Cheok CC, Ho RC. Global Outreach of a Locally-Developed Mobile Phone App for Undergraduate Psychiatry Education. JMIR Med Educ. 2015;1(1):e3.
19. Liu Y, Ren W, Qiu Y, Liu J, Yin P, Ren J. The Use of Mobile Phone and Medical Apps among General Practitioners in Hangzhou City, Eastern China. JMIR Mhealth Uhealth. 2016;4(2):e64. doi: 10.2196/mhealth.4508.
20. Davies MJ, Kotadia A, Mughal H, Hannan A, Alqarni H. The attitudes of pharmacists, students and the general public on mHealth applications for medication adherence. Pharm Pract (Granada). 2015;13(4):644. doi: 10.18549/PharmPract.2015.04.64.
21. Patel R, Green W, Shahzad MW, Larkin C. Use of Mobile Clinical Decision Support Software by Junior Doctors at a UK Teaching Hospital: Identification and Evaluation of Barriers to Engagement. JMIR Mhealth Uhealth. 2015;3(3):e80. doi: 10.2196/mhealth.4388.
22. Pauwels K, Aerts S, Muijzers E, De Jaegere E, van Heeringen K, Portzky G. BackUp: Development and evaluation of a smart-phone application for coping with suicidal crises. PLoS One. 2017;12(6):e0178144. doi: 10.1371/journal.pone.0178144.
23. Pereira-Azevedo N, Osório L, Fraga A, Roobol MJ. Rotterdam Prostate Cancer Risk Calculator: Development and Usability Testing of the Mobile Phone App. JMIR Cancer. 2017;3(1):e1. doi: 10.2196/cancer.6750.